Depression and Pain: Independent and Additive Relationships to Anger Expression

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14. ABSTRACT

Anger and anger expression are concerns in the military population. These constructs have been linked to stress dysregulation, heart disease, and poor coping behaviors such as substance abuse. Predisposing factors leading to anger expression are understudied. OBJECTIVE: This study was designed to examine the independent and additive relationships of depression and pain to anger expression (ANGX) in a large sample of military veterans. METHOD Subjects (N=474) completed the Center for Epidemiological Studies Depression Scale, a measure of average pain experienced across the last 4 weeks, and a measure of ANGX. A multiple regression model assessed the independent and additive relationships of depression and pain to ANGX. RESULTS: Subjects endorsed relatively high levels of depression (mean = 15.3 of possible 60), low???moderate levels of pain (mean = 6.3 of possible 20), and somewhat frequent episodes of ANGX. As expected, depression and pain were positively associated (r=0.42, p<0.001) and cross-over effects of antidepressant and pain medication were shown. Specifically, frequency of antidepressant medication use was inversely associated with both depressive symptoms (r=-0.34, p<0.001) and pain symptoms (r=-0.20, p<0.001). Likewise, frequency of pain medication use was inversely linked to both pain symptoms (r=-0.42, p<0.001) and depressive symptoms (r= -0.21 p<0.001). In a multiple regression model, depression (??=0.58, p<0.001) and pain (??=0.21, p<.05) demonstrated independent and additive relationships to ANGX (F=41.5, p<0.001, R2 adj =0.31). CONCLUSIONS: This study not only offers empirical support for depression???pain comorbidity, but it also elucidates independent and additive contributions of depression and pain to ANGX.

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Depression and Pain: Independent and Additive Relationships to Anger Expression

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ABSTRACT Anger and anger expression (ANGX) are concerns in the U.S. military population and have been linked to stress dysregulation, heart disease, and poor coping behaviors. Objective: We examined associations between depression, pain, and anger expression among military veterans. Method: Subjects (N = 474) completed a depression scale, a measure of pain across the last 4 weeks, and an ANGX scale. A multiple regression model assessed the independent and additive relationships of depression and pain to ANGX. Results: Almost 40% of subjects met the case definition for either major or minor depression. Subjects reported low-to-moderate levels of pain (mean = 6.3 of possible 20) and somewhat frequent episodes of ANGX. As expected, depression and pain were positively associated (r = 0.42, $p < 0.001$) and crossover effects of antidepressant and pain medication were shown. Specifically, frequency of antidepressant medication use was inversely associated with pain symptoms (r = −0.20, $p < 0.001$) and frequency of pain medication use was inversely linked to depressive symptoms (r = −0.21, $p < 0.001$). In a multiple regression model, depression ($\beta = 0.58$, $p < 0.001$) and pain ($\beta = 0.21$, $p < 0.05$) showed independent and additive relationships to ANGX ($F = 41.5$, $p < 0.001$, $R^2_{adj} = 0.31$). Conclusions: This study offers empirical support for depression–pain comorbidity and elucidates independent and additive contributions of depression and pain to ANGX.

INTRODUCTION

Anger is described as a basic human emotion, distinct from fear or disgust,[1] that ranges from irritation to rage experienced in response to unwanted or unexpected behavior of others.[2] It is a complex and multifaceted construct comprising physiological responses, brain activation, physical sensations, and subjective feelings.[3] Although conceptually germane, anger is differentiated from hostility, which encompasses an abiding dislike, mistrust, or negative evaluation of others, as well as aggression, which involves physical acts of violence that may emanate from factors distinct from anger (e.g., impulsiveness or dominance[4]). The latter construct, aggression, is frequently confused with or used interchangeably with "anger expression" (ANGX).[5] Although behaviors such as yelling at or striking another person are considered aggressive acts, they are further classified as ANGX when elicited by an angry emotion. ANGX, then, is best understood as a form of anger that is a "special case" of aggression. Thus, ANGX is operationalized as an overt verbally or physically aggressive act elicited by an angry emotion.

ANGX has been linked to stress dysregulation,[6] heart disease,[7] compromised wound healing,[8] and poor coping behaviors such as substance abuse.[9] Evidence also associates anger-related constructs with post-traumatic stress,[9] traumatic brain injury,[9] and risk taking[10] in military personnel. In a recent study of postcombat mental health problems and functional impairment of U.S. Army and National Guard soldiers, Thomas et al[11] found that, at 3 months after deployment, 43.1% of active duty soldiers endorsed getting angry with someone and kicking or smashing something at least once, 37.5% endorsed threatening someone with physical violence, and 17.7% reported getting into a fight with someone and hitting the person. Similar prevalence rates were observed in National Guard personnel. Also, some increases were observed in both groups from 3 to 12 months after deployment. A recent survey of 1,331 U.S. Marine Corps Reserve personnel suggested similar prevalence rates in this population (Hurtado et al, unpublished data). Altogether, anger and ANGX are of particular concern in military populations. On a practical level, mismanaged ANGX can disrupt normal function in family, work, and society, precipitating legal trouble, difficulties maintaining a job, or even domestic violence. Accordingly, clinicians often assist patients in identifying triggers of angry behavior so as to prevent destructive outcomes. Identifying and understanding such factors is a key step toward helping people understand, manage, or overcome problems with ANGX. Although there is a developing literature on state and trait anger indices, far less is known regarding ANGX. In particular, predisposing factors leading to ANGX are understudied, especially in at-risk populations such as military members.

Two important, interrelated health conditions that may potentiate or exacerbate ANGX are depression and pain. Both of these conditions are highly prevalent in the general population. Specifically, depression is ranked as the fourth leading cause of disability in the world[12]; the prevalence of major

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depressive disorder in primary care settings is estimated at 5% to 10%[13] based on structured interviews, and lifetime incidence in adults in the United States is estimated at 16%.[14] Likewise, prevalence estimates of persistent and/or chronic pain in adult populations range from 5% to 45%[15,16] and lifetime prevalence estimates of pain symptoms range from 24% to 37%.[17] Current evidence suggests that depression and pain are significant concerns in the military sector. Major depressive disorder is among the most prevalent self-reported mental health disorders in military personnel,[18,19] and combat exposure has been identified as a risk factor for new-onset depression.[20] As well, low back pain is one of the most common reasons military members seek medical attention in combat theaters,[21] and pain conditions are believed responsible for rendering a substantial number of military members nondeployable.[22] A growing literature explores common characteristics and shared biological pathways of depression and pain. This interaction has been termed "depression–pain syndrome" or "depression–pain dyad," suggesting that these conditions co-occur,[23] have reciprocal influence,[24] and may respond to similar treatments.[25,26] Bair and associates evaluated the comorbidity of depression and pain and concluded that the prevalence of pain in depressed cohorts (65% across 14 studies) and depression in pain cohorts (52% in pain clinics or inpatient pain programs across 15 studies) are considerably higher than when these conditions are examined individually. The authors also found that 13 of 22 studies of antidepressant treatment for pain symptoms and comorbid depression led to improvements in both conditions.

Limited research suggests that depression and pain produce additive impairments in health status,[27,28] quality of life,[23] and sleep.[29] For example, Kroenke et al[23] examined pain and depression in cancer patients, finding not only that 44% of their sample had comorbid depression and pain but also that this subgroup had more substantial quality of life and disability impairments compared with pain-only and depression-only subgroups. The influence of the depression–pain syndrome on behavioral outcomes, however, is understudied. Very limited data suggest that depression and pain independently associate with anger or anger-related constructs. Taft et al,[30] for example, showed that major depressive episode was among several predictors of aggression in male Vietnam veterans. Also, Thomas et al[11] showed that 50% of soldiers who screened positive for depression or post-traumatic stress disorder also met criteria for alcohol misuse or aggressive behavior (as acknowledged earlier, ANGX is one particular form of aggression). Likewise, experimental studies show that acute physical pain triggers increased anger and anger-related cognitions.[31] A systematic line of research suggests that anger and anger regulation strategies also prospectively influence pain responses[32,33]; thus, evidence suggests that reciprocating influences between pain and anger likely exist. Very little research quantifies the independent, additive, or interactive relationships of depression and pain to overt ANGX. This study was designed to examine the independent and additive relationships of depression and pain to ANGX in a large sample of military veterans.

METHOD

Demographics

Active duty U.S. Marine Corps personnel enrolled in a mandatory preseparation Transition Assistance Program (TAP) course at six Marine Corps installations were invited to participate in a future survey study of veteran reintegration into civilian life. Across sites, 2,116 Marines, representing 40% of eligible Marines in the TAP classes, consented. Approximately 9 months after the TAP classes, a follow-up survey was sent by both mail and e-mail to the participants who consented. Participants were given the option of mailing back the paper questionnaire or completing the questionnaire via the Internet. All eligible participants had transitioned from active duty military and were reintegrating into civilian life for a minimum of 2 months. The follow-up response rate was 25%; therefore, this study included 474 U.S. Marine Corps veterans (mean ± SD age = 27.4 ± 7.1 years) who had recently separated from military service. Survey procedures were approved by the Naval Health Research Center Institutional Review Board. Detailed subject characteristics are provided in Table I.

Measures

Center for Epidemiological Studies—Depression Scale

The Center for Epidemiological Studies—Depression Scale (CES-D)[34] is a 20-item scale developed by the National Institute of Mental Health. Respondents are asked to choose from four possible responses in a Likert format, where 0 is "rarely or none of the time (less than 1 day)," and 4 is "almost or all of the time (5–7 days)." Scores range from 0 to 60, with higher scores reflecting greater levels of depressive symptoms. Concurrent and construct validity have been shown for this scale,[34,35] and high internal consistency has been reported with Cronbach's α coefficients ranging from 0.85 to 0.90.[34] Internal consistency of the CES-D in the present study was 0.80.

Anger Expression Index

Four items adapted from Killgore et al[10] comprised this index. Subjects were asked to indicate how often since separating from the military he or she: got angry at someone and yelled or shouted at them; got angry with someone and kicked or smashed something; got into a fight with someone and hit the person; and threatened someone with physical violence. Answer choices ranged from 1 (never) to 5 (5 or more times). Cronbach's α coefficient in the present sample was 0.76.

Pain Index

This single-item measure was selected from the RAND 36-Item Short Form Health Survey 1.0.[36] Subjects were asked to select one number that best describes their pain on the average

TABLE I. Subject Characteristics

Characteristic	*N* (%)	Mean ± SD
Age (Years)		27.4 ± 7.1
Sex		
Male		
Female	38 (8.0)	
Pay grade		
Enlisted	441 (93.0)	
Officer	33 (7.0)	
Race/Ethnicity		
Caucasian (Non-Hispanic)	346 (73.0)	
African American	37 (7.8)	
Hispanic/Latino	71 (15.0)	
Indian	6 (1.3)	
Asian	12 (2.5)	
Pacific Islander	2 (0.4)	
Marital Status		
Married	193 (40.7)	
Single	281 (59.3)	
Number of Combat Deployments		
0	71 (15.0)	
1	124 (26.2)	
2	185 (39.0)	
3–4	56 (11.8)	
5–6	9 (1.9)	
7+	8 (1.7)	
Missing	21 (4.4)	
Anger Expression		
Gotten Angry, Yelled/Shouted at Someone		
Never	119 (25.1)	
1 Time	65 (13.7)	
2 Times	62 (13.1)	
3–4 Times	100 (21.1)	
≥5 Times	123 (25.9)	
Missing	5 (1.1)	
Gotten Angry, Kicked/Smashed Something		
Never	282 (59.5)	
1 Time	59 (12.4)	
2 Times	46 (9.7)	
3–4 Times	42 (8.9)	
≥5 Times	40 (8.4)	
Missing	5 (1.1)	
Threatened Someone With Physical Violence		
Never	323 (68.1)	
1 Time	48 (10.1)	
2 Times	33 (7.0)	
3–4 Times	30 (6.3)	
≥5 Times	35 (7.4)	
Missing	5 (1.1)	
Got Into Fight With Someone and Hit the Person		
Never	406 (85.7)	
1 Time	28 (5.9)	
2 Times	11 (2.3)	
3–4 Times	10 (2.1)	
≥5 Times	13 (2.7)	
Missing	6 (1.3)	
Depressive Symptoms		15.3 ± 11.9
Pain Symptoms		6.3 ± 5.0

over the past 4 weeks on a scale of 1 to 20. Higher scores reflected greater levels of pain.

Medication Use

Subjects were asked to indicate frequency of antidepressant and pain medication use within the past 12 months, respectively. For each of these two questions, answer choices ranged from 1 (52 days or more) to 8 (I have never used).

Statistical Analyses

Data were analyzed using SPSS software version 18.0 (SPSS, Chicago, Illinois). Distribution characteristics for all independent and dependent variables were examined to determine if assumptions of normality were met, following conservative predefined limits (e.g., skewness between −1 and 1, kurtosis between −3 and 3[37]). All variables were normally distributed. Descriptive analyses were conducted to summarize subject characteristics. Pearson product–moment correlations were performed to assess bivariate relationships between independent variables (depressive symptoms and pain symptoms), as well as crossover effects of antidepressant and pain medication. A multiple regression model assessed the unique and additive relationships of depressive symptoms and pain symptoms to ANGX, adjusting for covariates of age and officer/enlisted status. All hypothesis tests were two-sided, and the probability of committing a type I error was set at 0.05, although we reported when more stringent probabilities were achieved ($p < 0.01$ or $p < 0.001$).

RESULTS

Subjects endorsed somewhat frequent episodes of ANGX. A majority of respondents (74.6%) endorsed getting angry at someone and yelling or shouting at them at least once since separating from the military; 39.9% reported actions like getting angry with someone and kicking or smashing something, slamming the door, or punching the wall; 31.1% endorsed threatening someone with physical violence; and 13.2% of subjects endorsed getting into a fight with someone and hitting the person. Altogether, 76.2% reported engaging in one or more angry behavior at least once since separating from the military.

Numerous subjects endorsed clinically meaningful levels of depressive symptoms. Nearly one-fifth (18.6%) met the case definition of major depression (i.e., CES-D score >27), whereas an additional 19.1% met the case definition of mild depression (i.e., CES-D score 16–26[38]). Some subjects (5.1%) endorsed using antidepressant medication at least 52 days within the last 12 months. Subjects reported low-to-moderate pain severity (mean = 6.3 of possible 20), and 14.7% reported using pain medication at least 52 days within the past 12 months.

Subjects who had been deployed to a combat zone during their military career did not differ from nondeployers on depressive symptoms ($p = 0.73$), pain symptoms ($p = 0.96$),

or ANGX ($p = 0.92$). Those who had served as enlisted personnel endorsed higher depressive symptoms ($p < 0.001$), pain symptoms ($p < 0.05$), and ANGX ($p < 0.001$) than those who had served as commissioned officers. Older subjects tended to endorse less ANGX ($r = -0.16$, $p < 0.001$) but more pain symptoms ($r = -0.20$, $p < 0.001$) than younger subjects.

Depression and pain were positively associated ($r = 0.42$, $p < 0.001$). Frequency of antidepressant medication use was inversely associated with both depressive symptoms ($r = -0.34$, $p < 0.001$) and pain symptoms ($r = -0.20$, $p < 0.001$). Likewise, frequency of pain medication use was inversely linked to both pain symptoms ($r = -0.42$, $p < 0.001$) and depressive symptoms ($r = -0.21$, $p < 0.001$). Use of antidepressant medication and pain medication were positively related to each other ($r = 0.25$, $p < 0.001$).

Controlling for age and pay grade status (officer vs. enlisted), depressive symptoms ($\beta = 0.58$, $p < 0.001$), and pain symptoms ($\beta = 0.21$, $p < 0.05$) showed independent and additive relationships to ANGX ($F = 41.5$, $p < 0.001$, $R^2_{adj} = 0.31$). Per Table II, the interaction term (depression × pain) did not contribute significantly to the regression model ($p = 0.12$).

DISCUSSION

This study examined relationships of depression and pain to ANGX in a large sample of military veterans. Depression and pain were positively related to each other, and observed crossover effects of antidepressant and pain medication supported the theory of "common biological pathways." Also, depression and pain showed independent and additive relationships to ANGX.

Subjects in this study endorsed somewhat frequent episodes of ANGX. Nearly one in three, for example, endorsed threatening someone with physical violence. These findings are consistent with the recent work of Thomas et al,[11] showing similar prevalence 3 months after deployment in active duty and National Guard personnel of getting angry with someone and kicking or smashing something, threatening someone with physical violence, and getting into a fight with someone and hitting the person. Similar frequencies for these types of behaviors were observed in a recent survey of military personnel (Hurtado et al, unpublished data). Together, these findings substantiate that ANGX is an important behavioral health concern in the military sector warranting scientific attention. The prevalence of depressive symptoms in this population is equally concerning. Specifically, nearly one–fifth met the CES-D case definition of mild depression, whereas an additional one-fifth met the case definition of major depression. This resonates with the available epidemiologic evidence. As mentioned earlier, depression is a leading cause of disability,[12] and major depressive disorder is reported as the most prevalent mental health disorder in military personnel.[18,19] The concerning rates of ANGX and depression in the current study, then, are comparable to military populations in a post-deployment status, implying that the transition out of service may share common vulnerabilities with the transition home from military deployment.[39] From another perspective, this could also imply that these conditions do not abate simply as a function of separating from military. In addition, depression is a known predictor of suicide—an emergent behavioral health concern because suicides have increased markedly in military members in recent years.[40]

TABLE II. Linear Regression Model Examining Independent Variables[a], Covariates[b], and Dependent Variable[c]

Variable	Standardized β	t	p
Age	−0.17	−3.80	<0.001
Pay Grade	0.02	0.44	ns
Depressive Symptoms	0.58	7.32	<0.001
Pain Symptoms	0.21	3.04	<0.01
Depressive Symptoms/Pain Symptoms Interaction	−0.17	−1.54	ns

[a]Depression, pain. [b]Age, pay grade status. [c]Anger expression.

As expected, depressive symptoms and pain symptoms were positively linked. This is consistent with the depression–pain syndrome model describing comorbidity of these conditions and reciprocal influences. Specifically, patients with multiple pain symptoms are three to five times more likely to be depressed than patients without pain,[16] and the presence of pain symptoms doubles the risk for comorbid depression.[41] In a complementary finding, we observed crossover effects of antidepressant and pain medication; that is, antidepressant medication linked to fewer pain symptoms; whereas, use of pain medication associated with fewer depressive symptoms. Together, these findings are consistent with previous literature showing that depression and pain share common biological pathways[25] and, in turn, may respond to similar treatments.[26] Although a well-established ascending pathway theory holds that pain signals are transmitted from the periphery through the medulla, midbrain, hypothalamus, thalamus, and cortical structures, there is also growing interest in a "descending" pathway capable of dampening or amplifying nociceptive signals from the periphery. In this modulatory system, the periaqueductal gray is believed to relay messages from limbic structures (e.g., amygdala, hypothalamus, and frontal neocortex) to the pons and medulla,[42] thus implicating "psychological mechanisms" such as positive and negative affect in pain modulation. Of note, this system is primarily serotonin (5-hydroxytryptamine, or 5-HT)—and norepinephrine (NEPI)—mediated. In particular, the 5-HT-mediated pathways are capable of amplifying or dampening pain signals from the periphery via so-called "on-cells" and "off-cells," respectively. Likewise, neurobiological theories of depression[43] hold that 5-HT and NEPI (along with a host of other neurotransmitters, and neuroendocrine and inflammatory markers) may decrease, deplete, become unbalanced, or there may be altered numbers or affinities of their receptors. These effects may be disruptive to this pain modulation system. Furthermore, pharmacological evidence suggests that

the periaqueductal gray and relay sites of the descending pain pathway (including the limbic structures) are populated with opioid receptors, and that morphine (a common opioid pain medication) applied to any of these areas effectively blocks peripheral pain stimuli,[44] possibly by exciting "off-cells" and inhibiting "on-cells."[25] Similarly, administration of 5-HT and NEPI (common targets of antidepressant medication) has been shown to dampen peripheral pain signals.[44] Thus, the current findings substantiate the link between depression and pain and generally support theories of common biological pathways and crossover medication effects.

As hypothesized, depressive and pain symptoms showed both unique and additive relationships to ANGX. No interactive or synergistic relationships were observed. This is, to our knowledge, the first investigation of relationships of depression and pain to ANGX. However, recent studies have shown independent and/or additive relationships of these conditions to impaired health status,[27] quality of life,[23] and sleep disturbance.[29] Also, limited research suggests that depression and pain each independently associate with anger or anger-related constructs. Depression has been linked to aggressive behaviors in active duty military personnel[11] and veterans,[30] while other work shows that acute physical pain triggers angry cognitions.[31] Combined with the established aversive health consequences of ANGX, the substantial prevalence of ANGX observed in this study confirms the concerning nature of this behavior and iterates the importance of understanding its predisposing factors. As noted earlier, mismanaged anger or ANGX can disrupt normal function, therefore clinicians assist in identifying triggers of angry behavior. Management of the depression–pain syndrome and understanding its potential to trigger angry episodes may be crucial steps toward helping people overcome problems with ANGX. Future research is needed to replicate and extend the current findings, identify additional risk factors for ANGX, and examine the usefulness of interventions to manage ANGX in at-risk populations, preferably in randomized, controlled designs.

This study has several limitations. Importantly, we relied solely on self-report, which may have inflated the observed associations because of common method variance,[45] although Spector[46] concluded that this risk is typically overestimated. Also, we used a cross-sectional design, which must always be interpreted conservatively. Moreover, we did not quantify the specific type of antidepressant medication (e.g., tricyclic vs. selective serotonin reuptake inhibitor) or type of pain medication (e.g., nonsteroidal anti-inflammatory drugs vs. narcotics). This may have affected the fidelity with which crossover effects of antidepressant and pain medication were examined. Despite these limitations, this study signifies a distinct advancement in that it highlights the prevalence of ANGX in a vulnerable population and identifies depressive and pain symptoms as unique and additive risk factors for this potentially destructive behavior. Future research is needed to understand ANGX across military and civilian subgroups and elucidate additional risk factors for ANGX. Finally, there is a need to explore the utility of, and ultimately validate, interventions to mitigate ANGX in these populations.

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14. ABSTRACT

Anger and anger expression are concerns in the military population. These constructs have been linked to stress dysregulation, heart disease, and poor coping behaviors such as substance abuse. Predisposing factors leading to anger expression are understudied. **OBJECTIVE:** This study was designed to examine the independent and additive relationships of depression and pain to anger expression (ANGX) in a large sample of military veterans. **METHOD**: Subjects (N=474) completed the Center for Epidemiological Studies Depression Scale, a measure of average pain experienced across the last 4 weeks, and a measure of ANGX. A multiple regression model assessed the independent and additive relationships of depression and pain to ANGX. **RESULTS**: Subjects endorsed relatively high levels of depression (mean = 15.3 of possible 60), low–moderate levels of pain (mean = 6.3 of possible 20), and somewhat frequent episodes of ANGX. As expected, depression and pain were positively associated ($r=0.42$, $p<0.001$) and cross-over effects of antidepressant and pain medication were shown. Specifically, frequency of antidepressant medication use was inversely associated with both depressive symptoms ($r=-0.34$, $p<0.001$) and pain symptoms ($r=-0.20$, $p<0.001$). Likewise, frequency of pain medication use was inversely linked to both pain symptoms ($r=-0.42$, $p<0.001$) and depressive symptoms ($r= -0.21$, $p<0.001$). In a multiple regression model, depression ($\beta=0.58$, $p<0.001$) and pain ($\beta=0.21$, $p<.05$) demonstrated independent and additive relationships to ANGX ($F=41.5$, $p<0.001$, $R^2_{adj}=0.31$). **CONCLUSIONS:** This study not only offers empirical support for depression–pain comorbidity, but it also elucidates independent and additive contributions of depression and pain to ANGX.

15. SUBJECT TERMS
depression, pain, anger expression, military, depression–pain syndrome, depression–pain dyad

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